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'Siskiyou' Trailing Blackberry

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The primary goal of the U.S. Dept. of Agriculture–Agricultural Research Service (USDA–ARS) breeding program, in cooperation with Oregon State Univ., is the development of blackberry *(Rubus* sp.) cultivars that will complement or replace 'Marion' blackberry. While 'Marion' fruit are ideal for processing, the plants are thorny, susceptible to winter injury, and are too soft and tender-skinned for the fresh market (Finn et al.,1997). 'Black Butte', released in 1996, has extremely large fruit, and is early ripening and firm enough for local fresh-market sales, but it is not suitable for processing (Finn et al., 1998). 'Siskiyou' (pronounced sis´–ky$\bar{oo}$) is early, large-fruited, stress-tolerant, and is a dual-purpose berry for the fresh and processed market. Generally, trailing blackberries, such as 'Marion', 'Olallie', 'Boysen', and 'Waldo', are grown in mild climates where winter temperatures do not fall below –17 °C and they usually have very poor fruit quality if the fruit ripen when daytime temperatures are higher than 32 °C. 'Siskiyou' is widely adapted by trailing blackberry standards, but will probably have its greatest commercial impact in California and the Pacific Northwest. 'Siskiyou' is expected to become the early-season standard for the fresh market in the regions where it can be grown.

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Origin

'Siskiyou', tested as ORUS 830-4, is the result of a cross of ORUS 2027 ('Olallie' x ORUS 1367) x ORUS 1826 (ORUS 1122 x 'Boysen'), made in 1980 (Fig. 1), and is a septaploid based on analysis with flow cytometry (Meng, 1998). The original 'Siskiyou' plant was selected in a seedling field in 1983 in Corvallis, Ore. As with most trailing blackberry genotypes in our program, its genetic background is extremely diverse, and 'Boysen', 'Olallie', 'Marion', 'Eldorado', (a tetraploid eastern cultivar) and *R. ursinus* Cham. & Schldl. derivatives are all prominent in its pedigree. 'Siskiyou' has been an excellent parent; its progeny include 'Black Butte' (Finn et al., 1998) and two advanced selections that are currently in grower trials.

Description and performance

In the United States, 'Siskiyou' has been tested in Oregon (Corvallis and Aurora), Washington (Mt. Vernon), California (Modesto, Fresno), and North Carolina (Jackson Springs); additional tests have been conducted in British Columbia, Canada, and in New Zealand. The most thorough testing was done at the North Willamette Research and Extension Center of Oregon State Univ. at Aurora. The planting at Aurora was arranged in a randomized complete-block design, with four three-plant replications used for fresh fruit characteristics, harvest season, yield, and fruit weight. During the harvest season, fruit was harvested one or two times a week depending on the environmental conditions. The average fruit weight for a season is a weighted mean based on the weight of a randomly selected subsample of 25 fruit from each harvest. These data, collected from 1995–97, were analyzed as a split-plot in time with cultivar as the main plot and year as the subplot. While the planting included 15 genotypes, only the data from the cultivars Black Butte, Kotata, Marion, Ranui, and Waldo were included in the analysis (PROC GLM, SAS Institute, Cary, N.C.). In the analysis of these data, the cultivar × year interaction was significant for yield and fruit weight. Therefore, the interaction means for these variables are presented and compared using Duncan's multiple range test.

In most years, yields of 'Siskiyou' were similar to those of 'Marion' (Table 1). The average yield for 'Siskiyou' over 3 years was less than those of 'Waldo', 'Marion', and 'Kotata' but greater than those of 'Black Butte' and 'Ranui'. 'Siskiyou' appears to be more winter tolerant than 'Marion' and should yield better than 'Marion' following a severe winter. 'Siskiyou' fruit averaged 55% larger than fruits of 'Marion' and 'Kotata' but were not as large as those of 'Black Butte' (Table 1). 'Siskiyou' has a very high number of drupelets per fruit (Strik et al., 1996). Early-season

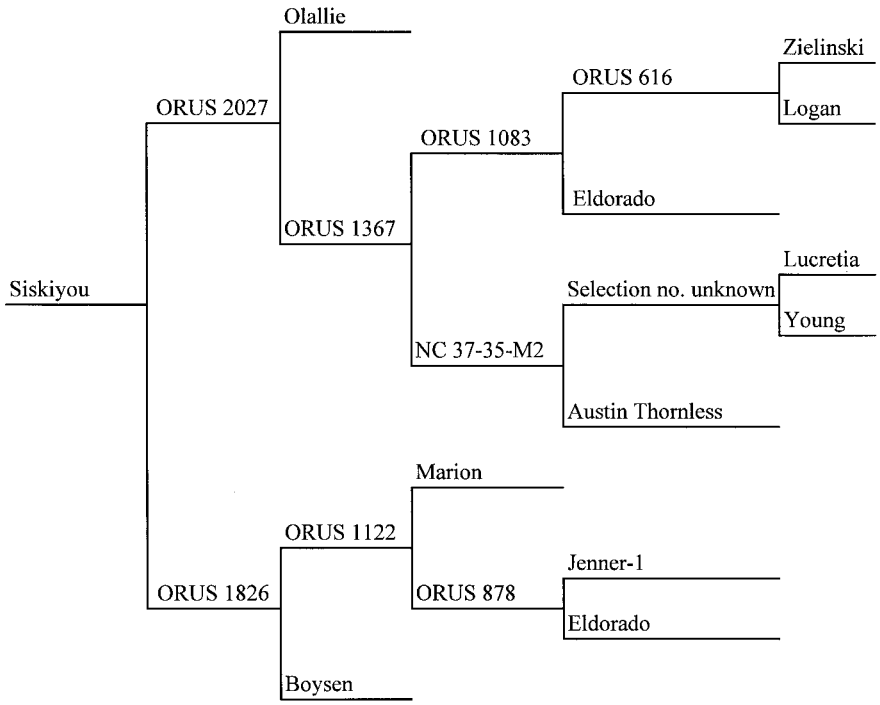

Fig. 1. Pedigree of 'Siskiyou' trailing blackberry.

'Siskiyou' fruit had 50% to 81% more drupelets than did 'Marion' fruit and over 130% more drupelets than fruit of 'Navaho' or 'Chester Thornless'. The fruit are cylindrical and blocky, lacking the conical tip of many of the trailing cultivars such as 'Marion' or 'Black Butte' (Fig. 2). Set of the drupelets at the tip of 'Siskiyou' fruit is not consistent. When this happens in large, primary berries, it goes unnoticed. In late-season fruit, the tip of the torus may be visible beyond the drupelets, but this has not been of concern to growers. The early fruit are of high quality and value and the later-ripening fruit are primarily processed as a puree or are not harvested. We do not know the cause of this problem. While it may be physiological, one hypothesis is that in hot weather the petals drop quickly, making the flowers unattractive to pollinators (Finn, 1996), before the later-maturing stigmas of the receptacle tip are receptive to pollen. 'Siskiyou' fruit are firmer and, based on grower/shipper experience, the epidermis of the drupelet is stronger than that of 'Marion' (data not shown). 'Siskiyou' fruit can be shipped for the fresh market whereas 'Marion' and most trailing cultivars cannot. Apparent "seediness" is low in 'Marion' and 'Siskiyou'. 'Siskiyou' has excellent fresh flavor but is not as strongly aromatic as 'Marion'. 'Siskiyou' can be mechanically harvested (data not shown).

In 1996, fruit from four replications of 'Siskiyou', 'Black Butte', 'Kotata', 'Marion', 'Ranui', and 'Waldo' from three harvest dates were pooled by cultivar and analyzed for soluble solids, pH, and titratable acidity; fruit were also evaluated for color as a puree, as thawed, individually quick frozen (IQF) fruit (Table 2) and as a juice (data not presented). 'Siskiyou' fruit had lower soluble solids than 'Waldo', but was similar to 'Marion' and the four other cultivars. The pH was slightly higher and the titratable acidity slightly lower than that of 'Marion'. 'Siskiyou was similar to 'Marion' for color characteristics, as a puree, and as IQF fruit (Table 2). In 1997, a panel representing blackberry growers, processors, and researchers was convened to evaluate fruit of 14 advanced blackberry selections and cultivars prepared as IQF, puree, and juice products (Yorgey et al., 1997). As an IQF fruit, 'Siskiyou' was similar in its overall score to 'Marion' and it was similar to 'Marion' in color, appearance, flavor, and perception of "seediness." As a puree, 'Siskiyou' was nearly indistinguishable from 'Marion' in overall quality, aroma, flavor, and appearance, although it was perceived to have a poorer color. As a juice, 'Siskiyou' was similar to 'Marion' in color, appearance, aroma, and flavor. 'Siskiyou' is recommended as a cultivar for processing based on the conclusions of Yorgey et al. (1997).

While the primary fruiting season of 'Siskiyou' is similar to that of 'Black Butte', it ripens its first fruit ≈4 d earlier (Table 3), and has consistently ripened 7 to 10 d before adjacent 'Cherokee' plants. The first fruit of 'Siskiyou' ripen ≈10 d ahead of 'Marion' and 'Kotata', and the midpoint of harvest can be 1 to 2 weeks ahead, but their ripening season can

Table 1. Yield and fruit weight of five trailing blackberry cultivars in a replicated trial at Oregon State Univ.–North Willamette Research and Extension Center (Aurora, Ore.) in 1995–97.

	Yield (kg·ha^{-1})				Wt (g/fruit)			
Cultivar	1995	1996	1997	Mean 1995–97	1995	1996	1997	Mean 1995–97
Waldo	7,978 b[z]	20,391 a	24,168 a	16,525 a	7.1 c	5.6 b	5.2 b	6.0 c
Marion	5,966 c	15,078 b	21,208 a	15,071 ab	5.8 d	4.7 c	4.7 bc	5.0 d
Kotata	13,063 a	16,810 ab	12,966 bc	14,280 b	6.2 cd	4.6 c	4.4 c	5.0 d
Siskiyou	5,619 c	14,319 b	15,191 b	11,710 c	8.7 b	7.0 a	7.7 a	7.8 b
Black Butte	7,153 bc	9,798 c	9,585 c	8,845 d	11.7 a	7.6 a	7.6 a	8.9 a
Ranui	2,371 d	8,734 c	11,609 bc	7,572 d	8.4 b	7.1 a	7.4 a	7.6 b

[z]Mean separation within columns by Duncan's multiple range test, $P \leq 0.05$.

Fig. 2. 'Siskiyou' blackberries.

Table 2. Mean value for five processing characteristics over three harvest dates in 1996 for six blackberry cultivars grown at Oregon State Univ.–North Willamette Research and Extension Center (Aurora, Ore.) in 1995–96.

				Hunter color[z]					
				Puree			Whole berry		
Cultivar	°Brix[y]	pH	Titratable acidity[y]	L*	a*	b*	L*	a*	b*
Black Butte	9.5 c[x]	3.3 a	1.5 b	29.0 a	10.8 a	3.0 a	10.7 a	7.0 a	3.0 a
Kotata	10.3 c	3.4 a	1.8 a	27.0 d	7.5 c	2.3 a	7.7 c	4.2 c	1.2 c
Marion	13.1 ab	3.1 b	1.9 a	27.5 b–d	10.0 ab	2.7 a	9.0 b	5.9 a–c	1.9 bc
Ranui	12.6 b	3.2 ab	1.8 a	27.9 b	9.8 ab	2.5 a	10.7 a	5.8 bc	1.9 bc
Siskiyou	11.4 bc	3.4 a	1.5 b	27.2 cd	8.1 bc	2.2 a	9.4 b	4.8 a–c	2.0 bc
Waldo	14.8 a	3.4 a	1.9 a	27.7 bc	8.9 a–c	2.1 a	8.9 b	7.3 a	2.3 ab

[z]Fresh fruit was frozen as individual, whole berries after harvest; color evaluations were performed on thawed, whole, and pureed fruit.
[y]°Brix (percent soluble solids) at 20 °C; titratable acidity= g citric acid/100 g fruit.
[x]Mean separation within columns by Duncan's multiple range test, $P \leq 0.05$.

Table 3. Midpoint of harvest and harvest season for five blackberry cultivars at Oregon State Univ.– North Willamette Research and Extension Center (Aurora, Ore.).

	Harvest season[z]			
	1996		1997	
Cultivar	Midpoint	Range (5% to 95%)	Midpoint	Range (5–95%)
Siskiyou	15 July	1 July–5 Aug.	30 June	19 June–21 July
Black Butte	15 July	5 July–29 July	30 June	23 June–15 July
Kotata	22 July	10 July–5 Aug.	15 July	30 June–21 July
Marion	22 July	10 July–29 July	15 July	30 June–21 July
Ranui	5 July	1 July–22 July	30 June	19 June–15 July
Waldo	29 July	15 July–12 Aug.	15 July	7 July–28 July

[z]Dates based on dates when yield reached 5%, 50% (midpoint), and 95% of total harvest for a cultivar.

extend for a longer period than that of either cultivar. 'Siskiyou' will likely become the early-season standard for commercial producers who sell to the fresh and processed market. For roadside/pick-your-own sales, 'Siskiyou' should complement 'Black Butte' in the early season.

'Siskiyou' canes are as vigorous as those of 'Marion' or 'Kotata'. The fruiting laterals extend from the plant and support the fruit without breaking, facilitating harvest. The canes are less thorny than those of 'Kotata', being more similar to 'Marion'.

The cold hardiness of 'Siskiyou' has not been fully determined. However, the winter of 1995–96 provided a good test; temperatures dropped to –11 to –12 °C on several nights during the first week of February, when the plants were fully dormant. While 'Marion' suffered some winter injury to flower buds, 'Siskiyou' exhibited no visible injury. Winter injury has never been identified as a problem with 'Siskiyou', and it has grown and fruited well for a number of years in British Columbia, Canada, where the temperatures and drying winds are more severe than in the Willamette Valley of Oregon.

Under a minimal spray program of dormant fungicides only, 'Siskiyou' has been more tolerant of cane, leaf, and fruit diseases than other trailing cultivars. 'Siskiyou' consistently scored better than 'Marion' for Septoria leaf spot (*Septoria rubi* Westend) and purple blotch [*Septocyta ruborum* (Lib.)Petr.]. 'Siskiyou' does not regularly exhibit vegetative symptoms of cane and leaf rust [*Kuehneola uredinis* (Link) Arth.] and this rust has never been seen on the fruit. In 1997, and to a lesser extent in 1998, 'Marion', 'Kotata', and 'Black Butte' were severely damaged by a "dry berry" syndrome. The cause of this problem is not known currently but is suspected to be a complex of diseases, particularly anthracnose [*Elsinoe veneta* (Burkholder) Jenk.], that develops under certain combinations of temperature and moisture. 'Siskiyou' has never shown symptoms of "dry berry." 'Siskiyou' has tested negative for tomato ringspot, raspberry bushy dwarf, and tobacco streak viruses by enzyme-linked immunosorbent assay (ELISA) and has indexed negative for each of these viruses when grafted on *R. occidentalis* L.

In California, 'Siskiyou' produces early, high-quality fruit for the fresh market. The fruiting season can extend to 60 d with the harvest evenly spread over this time and the plants are resistant to foliar and cane diseases (Charles Boyd, personal communication).

In North Carolina, 'Siskiyou' has done well in the Sandhills region. Although yields are relatively low, fruit quality is good, ripening is early, and plants survive the winter (James Ballington, personal communication). It has not performed well to date on upper Piedmont locations in North Carolina.

The outstanding characteristics of 'Siskiyou' are its very large, black, attractive, and firm fruit, ease of harvest, and early-season production, which are combined with a plant that is similar to or better than other thorny, trailing blackberry cultivars in habit, vigor, and resistance to disease. It is expected to do well where other trailing cultivars are adapted (typically mild climates where temperatures do not regularly fall below –18 °C) and is recommended for the processing market, for local fresh-market sales, and for fresh shipping.

Availability

'Siskiyou' is not patented. A list of nurseries that propagate and sell 'Siskiyou' is available from C.E.F., USDA–ARS Northwest Center for Small Fruit Research, 3420 NW Orchard Ave., Corvallis, OR 97330. Plants are available from the same address for nurseries interested in propagating it.

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